U.S. DEPARTMENT OF ENERGY
DEPARTMENT-WIDE
FUNCTIONAL AREA QUALIFICATION STANDARD

FACILITY MAINTENANCE MANAGEMENT QUALIFICATION STANDARD

Defense Nuclear Facilities Technical Personnel

U.S. Department of Energy
Washington, D.C. 20585

May 1995

Approval and Concurrence

The Associate Deputy Secretary for Field Management is the Management Sponsor for the Department-wide Facility Maintenance Management Functional Area Qualification Standard. The Management Sponsor is responsible for reviewing the Qualification Standard to ensure that the technical content is accurate and adequate for Department-wide application. The Management Sponsor, in coordination with the Human Resources organization, is also responsible for ensuring that the Qualification Standard is maintained current. Concurrence with this Qualification Standard by the Associate Deputy Secretary for Field Management is indicated by the signature below.

The Technical Personnel Program Coordinator (TPPC) is responsible for coordinating the consistent development and implementation of the Technical Qualification Program throughout the Department of Energy. Concurrence with this Qualification Standard by the Technical Personnel Program Coordinator is indicated by the signature below.

The Technical Excellence Executive Committee (TEEC) consists of senior Department of Energy managers. This Committee is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Technical Excellence Executive Committee is indicated by the signature below.

NOTE: **The signatures below reflect concurrence and approval of this Qualification Standard for interim Implementation. Final concurrence and approval will occur in December 1995, pending comments received based upon implementation.**

CONCURRENCE:

_____ _____

Associate Deputy Secretary for Field Management

Technical Personnel Program Coordinator

APPROVAL:

_____

Chairman
Technical Excellence Executive Committee

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U.S. DEPARTMENT OF ENERGY
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FUNCTIONAL AREA

Facility Maintenance Management

PURPOSE

The Technical Qualification Program is divided into three levels of technical competence and qualification. The General Technical Base Qualification Standard establishes the base technical competence required of all Department of Energy defense nuclear facility technical personnel. The Functional Area Qualification Standards build on the requirements of the General Technical Base Qualification Standard and establish Department-wide functional competence requirements in each of the identified functional areas. Office/facility-specific qualification standards establish unique operational competency requirements at the Headquarters or Field element, site, or facility level.

The Facility Maintenance Management Functional Area Qualification Standard establishes common functional area competency requirements for all Department of Energy facility maintenance management technical personnel who provide management oversight or direction impacting the safe operation of defense nuclear facilities. Satisfactory and documented completion of the competency requirements contained in this Standard ensures that technical employees possess the minimum requisite competence to fulfill their functional area duties and responsibilities. Additionally, these competency requirements provide the functional foundation to assure successful completion of the appropriate Office/facility-specific qualification standard.

APPLICABILITY

This Standard applies to all Department of Energy facility maintenance management personnel who provide management direction or oversight impacting the safe operation of defense nuclear facilities. Personnel designated by Headquarters or Field element line management as participants in the Technical Qualification Program are required to meet the requirements of this Standard as defined in DOE Order 3410, Training.

IMPLEMENTATION REQUIREMENTS

The competencies contained in the Standard are divided into the following four categories:

1. General Technical
2. Regulatory
3. Administrative
4. Management, Assessment, and Oversight

Each of the categories is defined by one or more competency statements indicated by bold print. The competency statements define the expected knowledge and/or skill that an individual must

possess, and are requirements. Each competency statement is further explained by a listing of supporting knowledge and/or skill statements. The supporting knowledge and/or skill statements are not requirements and do not necessarily have to be fulfilled to meet the intent of the competency.

The competencies identify a familiarity level, working level, or expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

Familiarity level is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.

Working level is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.

Expert level is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.

Demonstrate the ability is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field elements shall establish a program and process to ensure that all defense nuclear facility technical personnel required to participate in the Technical Qualification Program meet the competency requirements contained in this Standard. Documentation of the completion of the requirements of this Standard shall be included in the employee's training and qualification record.

In select cases, it may be necessary to exempt an individual from completing one or more of the competencies in this Functional Area Qualification Standard. Exemptions from individual competencies shall be justified and documented in accordance with DOE Order 3410, Training. Exemptions shall be requested by the individual's immediate supervisor, and approved one level above the individual's immediate supervisor.

Equivalencies may be granted for individual competencies based upon an objective evaluation of the employee's prior education, experience, and/or training. Documentation of equivalencies shall indicate how the competency requirements have been met. The supporting knowledge and/or skill statements may be considered when evaluating an individual's ability with respect to each competency requirement.

Training shall be provided to employees in the Technical Qualification Program who do not meet the competencies contained in the qualification standard. Departmental training will be based upon supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training courses used to provide individuals with the requisite knowledge and/or skill required to meet the qualification standard competency statements.

DUTIES AND RESPONSIBILITIES

The following are duties and responsibilities normally expected of defense nuclear facility technical personnel assigned to the facility maintenance management functional area:

A. Observe and evaluate facility maintenance activities and contractor performance to ensure adequacy and effectiveness.

B. Serve as the Department of Energy's technical point-of-contact and/or subject matter expert for applicable facility maintenance activities.

C. Evaluate and determine the adequacy of facility maintenance programs, policies, and procedures to determine compliance with applicable codes, standards, guides, regulations, DOE Orders, and accepted practices.

D. Review and analyze contractor performance, equipment failures, and occurrence data related to facility maintenance.

E. Ensure facility maintenance programs are integrated with other functional area programs (e.g., quality assurance, Conduct of Operations, and radiation protection).

F. Review and/or provide input to contractor annual programs and plans (e.g., award fee, budget, and operating plan).

Additional duties and responsibilities specific to the site, facility, operational activities, and/or other involved organizations shall be contained in the facility-specific qualification standard(s).

BACKGROUND AND EXPERIENCE

The U. S. Office of Personnel Management's Qualification Standards Handbook establishes minimum education, training, experience, or other relevant requirements applicable to a particular occupational series/grade level, as well as alternatives to meeting specified requirements.

The preferred education and experience for facility maintenance management personnel is:

1. Education:

   It is desirable for maintenance management personnel to have a Bachelor of Science degree in engineering or a related physical science degree; however, it is not a requirement. Experience requirements take precedence over education requirements for maintenance management personnel.

2. Experience:

   Industry or government experience that has provided specialized experience in managing maintenance programs at complex industrial or nuclear facilities (e.g., planning, executing, testing, and assessing maintenance activities). Specialized experience may be demonstrated through possession of the competencies outlined in this Standard.

REQUIRED COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All facility maintenance management personnel must complete the competency requirements of the General Technical Base Qualification Standard prior to or in parallel with the completion of the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and/or skill that an individual is required to possess to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements but are not requirements.

1. GENERAL TECHNICAL

1.1 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the basic components, operations, and theory of hydraulic and pneumatic systems.

Supporting Knowledge and/or Skills

a. Given a piping and instrumentation diagram (P&ID) of a typical hydraulic system, identify the main components, their functions, and discuss their relationships, to include:

- Receiver
- Accumulator
- Actuator

b. Given a piping and instrumentation diagram of a typical instrument air system, identify the main components to include:

- Compressor
- Dehydrator
- Receivers
- Unloader

c. Describe the basic operations of hydraulic and pneumatic systems.

d. Discuss how energy in hydraulic and pneumatic systems is converted to work.

e. Identify and discuss the hazards associated with hydraulic systems and their components.

f. Identify and discuss the general hazards associated with pneumatic systems and their components.

1.2 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of general valve construction and operation.

Supporting Knowledge and/or Skills

a. Define the following terms as they relate to valves:

- Disc
- Seat
- Throttle
- Actuator
- Bridgewall mark

b. Given a drawing of a valve, describe its normal design application in a piping system and identify which of the following general types of valve it is:

- Gate
- Globe
- Ball
- Check
- Butterfly
- Regulating/reducing

c. Given a diagram of a globe valve body showing the bridgewall mark, identify how the valve must be oriented in the system related to flow.

d. Discuss why gate valves, ball valves, and butterfly valves should never be used to throttle flow.

e. Define the following terms as they apply to safety and relief valves:

- Set point
- Pilot-actuated

f. Compare and contrast the purpose and operation of safety and relief valves.

1.3 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of a typical diesel engine including support systems.

Supporting Knowledge and/or Skills

a. Differentiate between two-stroke and four-stroke (two-cycle and four cycle) engines.

b. Discuss the underlying principle of the operation of a diesel engine.

c. Discuss the purpose of diesel engine support systems.

d. Using a cutaway drawing of a typical diesel engine, identify the main components.

1.4 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the theory and operation of air conditioning and refrigeration (AC&R) systems.

Supporting Knowledge and/or Skills

a. Define the following terms as they apply to air conditioning and refrigeration systems:

- Latent heat of vaporization
- Latent heat of fusion
- Refrigerant
- Vaporization point
- Air and non-condensible gases

b. Given a diagram of the basic refrigeration cycle, discuss the theory of operation of refrigeration systems.

c. Discuss the function of the components of a basic refrigeration system.

d. Discuss the hazards involved with handling refrigerants.

1.5 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of general piping system and heat exchanger construction and operation.

Supporting Knowledge and/or Skills

a. Define the following terms as they relate to piping systems:

- Pipe schedule
- Water hammer
- Hydrostatic test pressure
- Laminar flow
- Turbulent flow

b. Identify and discuss the typical causes and potential hazards of water hammer in piping systems.

c. Discuss the purpose of seismic restraints (i.e., whip restraints or snubbers) in piping systems.

d. Discuss the various materials used in piping systems with regard to application, benefits, and limitations.

e. Describe the difference between bucket and duplex strainers.

f. Describe the principles of operation for the following types of heat exchangers:

- Shell and tube
- Fin and tube
- Cooling tower

g. Given a cutaway drawing of the following types of heat exchangers, show the flow paths of the cooling medium and the medium to be cooled:

- Parallel flow
- Counter flow
- Cross flow

1.6 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of pump theory and operation.

Supporting Knowledge and/or Skills

a. Define the following terms as they relate to pumps:

- Head
- Net positive suction head (NPSH)

- Shut-off head
- Run-out
- Centrifugal pump
- Positive displacement pump

b. Describe the general principle of operation for centrifugal pumps.

c. Describe the general principle of operation for positive displacement pumps.

d. Given a cutaway drawing of a centrifugal pump, identify the following components and discuss their purpose:

- Impeller
- Packing or mechanical seal
- Volute

e. Describe the difference in starting a centrifugal and positive displacement pumps.

f. Discuss the concept of pump cavitation and describe its harmful effects.

1.7 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the basic construction, operation, and theory of heating, ventilation, and air conditioning (HVAC) systems.

Supporting Knowledge and/or Skills

a. Given a one-line diagram of a heating, ventilation and air conditioning system, identify the following components and discuss their purpose:

- Blowers/fans
- Dampers
- Chillers
- Filters

b. Discuss the relationships between the following in heating, ventilation and air conditioning systems:

- Supply ventilation
- Flow
- Exhaust ventilation

c. Identify and discuss when maintaining a negative pressure in an heating, ventilation and air conditioning system is desirable.

d. Describe the following types of filters:

- Cartridge filters

- Precoated filters
- Deep-bed filters
- High Efficiency Particulate (HEPA) filters

e. Discuss the principle application of high efficiency particulate filters.

f. Identify and describe the hazards associated with high efficiency particulate filters, including any fire safety concerns.

1.8 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the terminology and theory of basic electrical fundamentals.

Supporting Knowledge and/or Skills

a. Discuss the following terms:

- Electrostatic force
- Electrostatic field
- Conductor
- Insulator
- Resistor

b. Describe the following parameters and discuss their relationship:

- Voltage
- Current
- Resistance
- Ohm's Law
- Power
- Inductance
- Capacitance

1.9 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the basic electrical fundamentals of direct current (DC) and alternating current (AC).

Supporting Knowledge and/or Skills

a. Discuss the basic principle(s) by which the following components produce direct current (DC):

- Battery
- Direct current (DC) generator
- Thermocouple

b. Discuss the purpose of a rectifier.

c. Discuss the following terms:

- Resistivity
- Electric circuit
- Series circuit
- Parallel circuit

d. Discuss the following terms:

- Battery
- Electrode
- Electrolyte
- Specific-gravity
- Ampere-hour

e. Describe the construction and operation of an alternating current (AC) generator.

f. Describe the relationship between apparent, true, and reactive power by definition or by using a power triangle.

g. Discuss the reasons that three-phase power systems are used in industry.

h. Describe how a rotating magnetic field is produced in an alternating current motor.

i. Discuss the purposes of a transformer.

1.10 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the basic electrical fundamentals of electrical distribution systems.

Supporting Knowledge and/or Skills

a. Explain the following terms as they apply to electrical distribution systems:

- Diesel power
- Uninterruptable power supply (UPS)
- Neutral grounding
- Voltage class
- Protective relays

b. Describe the protection provided by fuses and circuit breakers.

c. Describe the purpose and functions of a motor controller.

d. Describe the difference between single-phase loads and three-phase loads.

1.11 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the principles of operation, purpose and uses of process instrumentation.

Supporting Knowledge and/or Skills

a. Explain the reason for measuring temperature, pressure, flow, and fluid level.

b. List the three basic functions that temperature, pressure, flow, and fluid level detectors provide.

c. For the detection devices listed below, explain how the instrument provides an output representative of the signal being measured:

- Thermocouple (TC)
- Resistance temperature detector (RTD)
- Bellows
- Bourdon tube
- Gauge-glass
- Conductive probe
- Differential pressure
- Ball float
- Orifice plate
- Venturi tube
- Pitot tube
- Electromagnetic

1.12 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the principles of operation and use of control systems .

Supporting Knowledge and/or Skills

a. Define and discuss the application of each of the following:

- Control system
- Control system input
- Control system output
- Control system feedback

b. Describe an automatic control system, including the functions required for an automatic control system to operate.

c. Referring to a basic block diagram of a control system, explain the function of the elements.

1.13 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of fundamental chemistry theory and the periodic table.

Supporting Knowledge and/or Skills

a. Describe the three possible states of matter.

b. Explain the structure of an atom.

c. Discuss the following terms:

- Element
- Molecule
- Avogadro's Number
- Mole

d. Given a periodic table, identify and explain the significance of the arrangement of elements, to include the following:

- Periods of the table
- Classes of the table
- Group characteristics

1.14 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the fundamentals of chemical bonding and chemical reactions.

Supporting Knowledge and/or Skills

a. Discuss the following types of chemical bonds:

- Ionic
- Covalent
- Metallic

b. Discuss how elements combine to form chemical compounds.

c. Discuss the following terms:

- Mixture
- Solvent
- Solubility
- Solute
- Solution
- Equilibrium

d. Discuss the following terms:

- Density
- Molarity
- Parts per million (ppm)

e. Define the following terms:

- Acid
- Base
- pOH
- Salt
- pH

1.15 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the chemical fundamentals of corrosion and water treatment.

Supporting Knowledge and/or Skills

a. Explain the process of general corrosion of iron and steel when exposed to water.

b. Discuss the two conditions that can cause galvanic corrosion.

c. Discuss the following types of specialized corrosion:

- Pitting corrosion
- Stress corrosion cracking
- Crevice corrosion

1.16 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the fundamentals of chemical safety.

Supporting Knowledge and/or Skills

a. Discuss the hazards associated with the use of corrosives (acids and alkalies).

b. Describe the general safety precautions necessary for the handling, storage, and disposal of corrosives.

c. Discuss the general safety precautions for toxic compounds.

d. Describe the criteria used to determine if a compound is a health hazard and Discuss the methods by which toxic compounds may enter the body.

e. Discuss the general safety precautions for the use, handling, and storage of compressed gases, specifically including, hydrogen, oxygen, and nitrogen.

f. Discuss the safety precautions for working with cryogenic liquids.

g. Explain the difference between a flammable material and a combustible material.

h. Describe the general safety precautions for the use, handling, and storage of flammable and combustible materials.

1.17 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of basic concepts and theories of thermodynamics, heat transfer and fluid flow.

Supporting Knowledge and/or Skills

a. Define the following terms:

- Specific volume
- Density
- Specific gravity
- Mass
- Weight

b. Describe the thermodynamic properties of temperature and pressure.

c. Describe the following types of thermodynamic systems:

- Isolated system
- Open system
- Closed system

d. Discuss the First Law of Thermodynamics.

e. Discuss the Second Law of Thermodynamics.

f. Using the ideal gas law, discuss the relationship between pressure, temperature, and volume.

g. Describe when a fluid may be considered to be incompressible.

h. Describe the effects of pressure and temperature changes on confined fluids.

i. Describe the three modes of heat transfer.

j. Define the terms "mass flow rate" and "volumetric flow rate."

k. Define the property of viscosity.

l. Define the terms "head", "head loss", and "frictional loss", with respect to their use in fluid flow.

1.18 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the basic concepts, theories, and principles of material science.

Supporting Knowledge and/or Skills

a. State the five types and the characteristics of bonding that occur in materials.

b. Describe the characteristics of the following crystal structures:

- Body-centered cubic structure
- Face-centered cubic structure
- Hexagonal close-packed structure

c. Discuss the following terms:

- Compressibility
- Stress
- Shear stress
- Tensile stress
- Compressive stress

d. Define the following terms:

- Strain
- Proportional limit
- Plastic deformation

e. Discuss the following terms:

- Strength
- Malleability
- Ductility
- Toughness
- Yield strength
- Hardness
- Ultimate tensile strength

f. Discuss the phenomenon of thermal shock.

g. Discuss the effects of radiation on the structural integrity of metals.

1.19 Facility maintenance management personnel shall demonstrate the ability to read and interpret engineering piping and instrument drawings (P&ID).

Supporting Knowledge and/or Skills

a. Identify the symbols used on engineering piping and instrument drawings for:

- Types of valves
- Types of valve operators
- Types of eductors and ejectors
- Basic types of instrumentation
- Types of instrument signal controllers and modifiers
- Types of system components (pumps, etc.)
- Types of lines

b. Identify the symbols used on engineering piping and instrument drawings to denote the location of instruments, indicators, and controllers.

c. Identify how valve conditions are depicted.

d. Determine system flowpath(s) for a given valve lineup.

e. Given a fluid power drawing, determine the operation or resultant action of the stated component when hydraulic pressure is applied/removed.

1.20 Facility maintenance management personnel shall demonstrate the ability to read and interpret electrical diagrams and schematics.

Supporting Knowledge and/or Skills

a. Identify the symbols used on engineering electrical drawings.

b. Identify the symbols and/or codes used on engineering electrical drawings to show the relationship between components.

c. State the condition in which all electrical devices are shown, unless otherwise noted on the diagram or schematic.

d. Given a simple electrical schematic and initial conditions, identify the power sources and/or loads and their status.

1.21 Facility maintenance management personnel shall demonstrate the ability to read and interpret an electrical logic diagram.

Supporting Knowledge and/or Skills

a. Identify the symbols used on electrical logic diagrams to represent the components.

b. Explain the operation of the three types of time delay devices.

c. Identify the symbols used to denote a logical "1" (or high) and a logical "0" (or low) as used in logic diagrams.

d. Given an electrical logic diagram and appropriate information, determine the output of each component and the logic circuit.

1.22 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of safety documentation and safety-related structures, systems, and components.

Supporting Knowledge and/or Skills

a. Identify safety-related structures and systems.

b. Describe the process to identify safety-related structures, systems, and/or components.

c. Discuss the special requirements placed on safety-related structures, systems, and components.

1.23 Facility maintenance management personnel shall demonstrate a working level knowledge of the guidelines for maintaining maintenance facilities, equipment, and tools.

Supporting Knowledge and/or Skills

a. Discuss the importance of maintaining proper maintenance facilities.

b. Describe the criteria used when designing the layout of a shop or satellite work area.

c. Discuss when temporary facilities are used, the factors to consider when approving, purchasing, designing and locating temporary facilities.

d. Discuss the reasons for segregating tools.

e. Discuss the use of contaminated tools versus clean tools.

f. Discuss the concerns affecting the selection and state of readiness of maintenance facilities.

g. Describe the objective of maintenance facilities.

h. Describe the types and levels of environmental controls and services included in shops and satellite work areas.

i. Discuss the elements to consider when planning for the identification and use of maintenance laydown and staging areas.

j. Discuss the issues addressed when determining storage facility needs.

k. Discuss the requirements for storing, issuing, and maintenance of tools and equipment.

l. Describe the requirements for office equipment to support the maintenance organization.

m. Discuss the criteria of a program for the development of new or special tools and equipment.

1.24 Facility maintenance management personnel shall demonstrate a working level knowledge of the application of the different types of maintenance.

Supporting Knowledge and/or Skills

a. Discuss and compare the following:

- Corrective maintenance
- Preventive maintenance
- Predictive maintenance

b. Describe the purpose, use, and content of a master equipment list.

c. Discuss the role of the types of maintenance in an effective and efficient maintenance program.

d. Discuss the relationship between predictive maintenance and technical safety requirements.

e. Discuss the importance of maintaining a proper balance of preventive, predictive, and corrective maintenance.

f. Discuss the elements needed to successfully implement a maintenance program that balances the three types of maintenance.

g. Describe the relationship in scheduling between preventive and predictive maintenance.

h. Discuss the relationship between the results of predictive maintenance and preventive maintenance.

i. Discuss the considerations used when determining maintenance actions and their frequencies.

j. Define the term "life limiting component" and its impact on facility operation.

1.25 Facility maintenance management personnel shall demonstrate a working level knowledge of the documentation used for controlling maintenance.

Supporting Knowledge and/or Skills

a. Discuss the purpose, use, and content of a work package.

b. Discuss the purpose, use, and contents of maintenance procedures including the following considerations:

- Development, including human factor considerations
- Verification
- Validation
- Approval
- Actions taken when procedures cannot be followed as written or when unexpected results occur.

c. Discuss the considerations for developing maintenance procedures.

d. Describe the control, review, and revision of maintenance procedures.

e. Discuss the minimum items addressed in effective work control procedures.

1.26 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements for controlling maintenance activities.

Supporting Knowledge and/or Skills

a. Discuss the elements of an effective work control program, including the following:

- Adherence to facility procedures, practices, and policies
- Work control procedures
- Work requests
- Review of completed work requests
- Control of temporary repairs
- Control of non-facility contractor and sub-contractor personnel
- Work site cleanliness
- Job briefings
- Control of troubleshooting
- Tagout/lockouts, radiological work permits, confined space permits
- Independent verification requirements
- Maintenance problem identification, correction, and evaluation
- Deficiency identification and correction
- Response to abnormal maintenance conditions
- Configuration control

b. Describe the maintenance supervisor's role and responsibilities in the supervision of maintenance activities and review of completed work requests.

1.27 Facility maintenance management personnel shall demonstrate a working level knowledge of planning, scheduling, and coordination of maintenance activities.

Supporting Knowledge and/or Skills

a. Discuss the importance of planning, scheduling, and coordinating maintenance activities.

b. Discuss the prioritization of maintenance activities.

c. Describe the elements of a priority system used for maintenance planning.

d. Define backlog.

e. Discuss the use of backlog as a management tool (mission, goals, budget, and staff).

f. Describe the elements of a system used to manage the maintenance backlog.

g. Understand and describe the relationship between operations and maintenance organizations. Include a discussion on resource and time requirements.

h. Discuss the role of planning meetings to coordinate activities.

i. Describe the importance of pre-briefings and what should be included in a pre-brief.

j. Discuss the relationship between normal maintenance and outage maintenance.

k. Discuss the requirements for scheduling and coordinating planned outages.

l. Discuss the requirements for scheduling and coordinating forced outages or other limitations to facility operations.

1.28 Facility maintenance management personnel shall demonstrate a working level knowledge of industrial property management practices as related to stores, spare parts, and essential materials.

Supporting Knowledge and/or Skills

a. Discuss how component availability impacts plant reliability and safety.

b. Discuss the concerns related to maintaining inventory of critical components that affect limiting conditions of operations.

c. Describe the following terms as they relate to procurement:

- Just-in-time
- Shelf life
- Long lead time

d. Describe the Department's procurement process.

e. Describe controls that should be developed and maintained throughout the procurement process.

1.29 Facility maintenance management personnel shall demonstrate a working level knowledge of the control and calibration of measuring and test equipment .

Supporting Knowledge and/or Skills

a. Discuss the elements that are included in a comprehensive measuring and test equipment program.

b. Describe the guidelines for the identification of measuring and test equipment.

c. Discuss the following aspects of calibration as they relate to measuring and test equipment:

- Calibration standards
- Calibration procedures

- Calibration frequency
- Functional checks

d. Describe the four-to-one rule.

e. Discuss the requirements for the control of measuring and test equipment.

f. Discuss the storage, segregation, and labeling of measuring and test equipment.

g. Describe the methods used for resolving out-of-calibration equipment.

h. Discuss the issuance and recall of measuring and test equipment.

i. Describe the actions taken for contaminated measuring and test equipment.

j. Discuss the guidelines for the evaluation of measuring and test equipment.

1.30 Facility maintenance management personnel shall demonstrate a working level knowledge of modification work.

Supporting Knowledge and/or Skills

a. Describe the difference between temporary and permanent repairs/work.

b. Discuss the restrictions associated with temporary modifications.

c. Explain who can authorize temporary modifications.

d. Describe the process for temporary modifications.

e. Discuss the requirements and controls in place to prevent unapproved modifications.

1.31 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements of post-maintenance testing.

Supporting Knowledge and/or Skills

a. Discuss the importance of post-maintenance testing.

b. Describe the elements of an effective post-maintenance testing program.

c. Describe the scope, such as equipment, systems, or activities, of a post-maintenance testing program.

d. Describe the control of a post-maintenance testing program.

e. Discuss the requirements of test performance, documentation, and acceptance of post-maintenance testing.

1.32 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements for material receipt, inspection, handling, storage, retrieval, and issuance.

Supporting Knowledge and/or Skills

a. Discuss the requirements for the receipt and inspection of parts, materials, and equipment.

b. Discuss the requirements for establishing a procedure for items requiring special handling instructions.

c. Discuss the requirements for storing material and equipment.

d. Describe examples of items that should be observed and corrected during periodic general inspections of stores.

e. Discuss the requirements for retrieving and issuing of parts, materials, or equipment.

1.33 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements of maintenance tools and equipment control.

Supporting Knowledge and/or Skills

a. Discuss the criteria of a program for the development of new or special tools and equipment.

b. Discuss the guidelines for storing and issuing maintenance tools and equipment.

c. Discuss the guidelines for tool and equipment maintenance.

1.34 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements for facility condition inspections.

Supporting Knowledge and/or Skills

a. Explain the purpose of a Facility Condition and Housekeeping Program.

b. Discuss the elements of an effective inspection program.

c. Describe indicators of good facility conditions and housekeeping standards.

d. Discuss the elements of an effective procedure addressing facility condition inspections.

e. Describe the importance of training personnel in inspection techniques.

f. Describe the elements of routine inspections.

g. Discuss the requirements for reporting deficiencies and deficiency follow-up.

1.35 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements for management involvement.

Supporting Knowledge and/or Skills

a. Discuss the importance of management's involvement in maintenance.

b. Discuss the role and responsibilities of maintenance managers.

c. Discuss the guidelines for management involvement, objective results, and feedback in relation to a maintenance program.

d. Discuss the elements of a maintenance program evaluation.

1.36 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements of maintenance history.

Supporting Knowledge and/or Skills

a. Discuss the importance of maintaining a maintenance history.

b. Describe the guidelines for the following elements of a maintenance history program development:

- Equipment identification
- Data identification

c. Describe the guidelines for data collection.

d. Discuss common uses of a maintenance history.

e. Describe configuration control and its relationship to the maintenance work control process and the maintenance history file.

1.37 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the principles and concepts of natural phenomena hazards and their effect on systems and structures.

Supporting Knowledge and/or Skills

a. Discuss the potential impact on systems and structures at defense nuclear facilities from the following natural hazards:

- Flooding
- Wind
- Tornado
- Earthquake and/or other seismic events
- Fire
- Lightning

b. Briefly describe the safety measures and design features commonly used as safeguards against natural hazards.

2. REGULATORY

NOTE 1: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

2.1 Facility maintenance management personnel shall demonstrate a working level knowledge of the Department of Energy's requirements for facility maintenance management as outlined in DOE Order 4330.4B, Maintenance Management Program.

Supporting Knowledge and/or Skills

a. Explain the Department of Energy's role in the oversight of contractor maintenance operations.

b. Explain the intent of DOE Order 4330.4B, Maintenance Management Program.

c. Discuss the Department's policy and objectives for maintenance management.

d. Describe responsibilities and authorities for maintenance management programs.

e. Describe the purpose, scope and requirements of Maintenance Implementation Plans (MIPs).

f. Describe the provisions to allow nuclear facility program elements to include non-nuclear equipment.

g. Discuss the requirements for the control of Management & Operating (M&O) contractor and subcontractor personnel.

h. Describe the relationship between 10CFR830.120, DOE Order 5700.6C, Quality Assurance, and DOE Order 4330.4B, Maintenance Management Program, in relation to work processes and maintenance activities.

i. Describe the relationship between DOE Order 4320.2A, Capital Asset Management Process, and DOE Order 4330.4B, Maintenance Management Program, in relation to condition assessment surveys.

j. Describe the relationship between DOE Order 4320.1B, Site Development Planning and DOE Order 4330.4B, Maintenance Management Program.

k. Describe the relationship between DOE Order 4330.2C, In-house Energy Management, and DOE Order 4330.4B, Maintenance Management Program.

l. Describe maintenance backlog work and identify criteria used to establish a proper magnitude of maintenance backlog.

m. Discuss the graded approach process by which Department line management determines an appropriate level of coverage by facility maintenance management personnel. Include in this discussion factors that may influence the level of coverage.

2.2 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements for training and qualification program as identified in the following Department of Energy (DOE) Orders:

- **DOE Order 5480.20, Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities**
- **DOE Order 4330.4B, Maintenance Management Program**

Supporting Knowledge and/or Skills

a. Discuss the meaning of qualification and its importance to maintenance.

b. Describe the purpose and scope of DOE Order 5480.20, Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities.

c. Discuss why certain skills or proficiencies should be demonstrated periodically.

d. Using DOE Order 5480.20, Personnel Selection, Qualification, Training, and Staffing Requirements as a reference, describe the general requirements to which a Management and Operating (M&O) contractor is held at Category 1, 2, and 3 facilities in the following areas:

- Qualification and certification of facility personnel
- Training and qualification of sub-contractors
- Continuing training and requalification
- Exceptions and alternatives to requirements of DOE Order 5480.20
- Personnel selection
- Training and qualification

e. Using DOE Order 5480.20, Personnel Selection, Qualification, Training, and Staffing Requirements as a reference, state the entry level requirements for various facility positions.

f. Describe the purpose and scope of Chapter II, Section 3, of DOE Order 4330.4B, Training and Qualification of Maintenance Personnel.

g. Discuss the responsibility of the maintenance organization in the training and qualification of their personnel.

h. Discuss the requirements of Chapter II, Section 3, DOE Order 4330.4B, Training and Qualification of Maintenance Personnel, regarding training facilities.

i. Describe the elements of an effective on-the-job training program.

j. Discuss the maintenance manager's responsibilities in the approval, effectiveness, and feedback cycles of the maintenance training program.

2.3 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the facility maintenance management-related sections and/or requirements of the following related Department of Energy (DOE) Orders:

- **DOE Order 4320.2A, Capital Asset Management Process**
- **DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards**
- **DOE Order 5480.10, Contractor Industrial Hygiene Program**
- **DOE Order 5480.11, Radiation Protection for Occupational Workers**
- **DOE Order 5483.1A, Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities**
- **DOE Order 6430.1A, General Design Criteria**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the requirements detailed in the Orders above listed.

b. Discuss the impact and/or relationship of the Orders listed above to the facility maintenance management functional area.

2.4 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the following maintenance management-related Department of Energy Technical Standards:

- **DOE-STD-1050-93, Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities**
- **DOE-STD-1051-93, Guideline to Good Practices for Maintenance Organization and Administration at DOE Nuclear Facilities**
- **DOE-STD-1052-93, Guideline to Good Practices for Types of Maintenance at DOE Nuclear Facilities**
- **DOE-STD-1053-93, Guideline to Good Practices for Control of Maintenance Activities at DOE Nuclear Facilities**
- **DOE-STD-1054-93, Guideline to Good Practices for Control and Calibration Measuring and Test Equipment (M&TE) at Nuclear Facilities**
- **DOE-STD-1055-93, Guideline to Good Practices for Maintenance Management Involvement at DOE Nuclear Facilities**
- **DOE-STD-1064-94, Guideline to Good Practices for Seasonal Facility Preservation at DOE Nuclear Facilities**
- **DOE-STD-1065-94, Guideline to Good Practices for Postmaintenance Testing at DOE Nuclear Facilities**
- **DOE-STD-1067-94, Guideline to Good Practices for Maintenance Facilities, Equipment, and Tools at DOE Nuclear Facilities**
- **DOE-STD-1069-94, Guideline to Good Practices for Maintenance Tools and Equipment Control at DOE Nuclear Facilities**
- **DOE-STD-1071-94, Guideline to Good Practices for Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance at DOE Nuclear Facilities**

- **DOE-STD-1072-94, Guideline to Good Practices for Facility Condition Inspections at DOE Nuclear Facilities**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the requirements detailed in the Technical Standards listed above.

b. Discuss the impact and/or relationship of the above referenced Technical Standards to the facility maintenance management functional area.

2.5 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the Department of Energy, DOE Order 5000.3, Occurrence Reporting and Processing of Operations Information.

Supporting Knowledge and/or Skills

a. State the purpose of DOE Order 5000.3, Occurrence Reporting and Processing of Operations.

b. Define the following terms:

- Event
- Condition
- Facility
- Notification report
- Occurrence report
- Reportable occurrence

c. Discuss the Department's policy regarding the reporting of occurrences as outlined in the DOE Order 5000.3, Occurrence Reporting and Processing of Operations.

d. State the different categories of reportable occurrences and discuss each.

e. Refer to Attachment 1 of DOE Order 5000.3, Occurrence Reporting and Processing of Operations and discuss the role of facility maintenance personnel in maintenance-related reportable occurrences.

2.6 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of DOE Order 5700.6C, Quality Assurance, as it pertains to facility maintenance.

Supporting Knowledge and/or Skills

a. Describe the types of documents related to facility maintenance that should be controlled by a document control system.

b. Discuss the requirements for revision and distribution of controlled documents.

c. Discuss the determination of calibration frequency for measurement and test equipment.

d. Describe the effect of using inappropriate calibration standards on test equipment.

e. Discuss the key elements of the procurement process for facility maintenance as described in DOE Order 5700.6C, Quality Assurance.

2.7 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of DOE Order 5480.21, Unreviewed Safety Questions.

Supporting Knowledge and/or Skills

a. Discuss the reasons for performing an Unreviewed Safety Question determination .

b. Define the following terms:

- Accident Analyses
- Safety Evaluation
- Technical Safety Requirements

c. Describe the situations in which a safety evaluation is required to be performed.

d. Define the conditions for an Unreviewed Safety Question.

e. Describe the responsibilities of contractors authorized to operate defense nuclear facilities regarding the performance of safety evaluations.

f. Describe the actions to be taken by a contractor upon identifying information that indicates a potential inadequacy of previous safety analyses or a possible reduction in the margin of safety as defined in the Technical Safety Requirements.

2.8 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the Technical Safety Requirements as described in DOE Order 5480.22, Technical Safety Requirements.

Supporting Knowledge and/or Skills

a. Discuss the purpose of the Technical Safety Requirements.

b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities regarding the Technical Safety Requirements.

c. Define the following terms and discuss the purpose of each:

- Safety limit
- Limiting control settings
- Limiting conditions for operation
- Surveillance requirements

d. Describe the general content of each of the following sections of the Technical Safety Requirements:

- Use and application
- Safety limits
- Operating limits
- Surveillance requirements
- Administrative controls
- Basis
- Design features

2.9 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of Nuclear Safety Analysis Reports as described in DOE Order 5480.23, Nuclear Safety Analysis Reports.

Supporting Knowledge and/or Skills

a. Discuss the basic purposes and objectives of Nuclear Safety Analysis Reports.

b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities regarding the development and maintenance of a Nuclear Safety Analysis Report.

c. Define the following terms and discuss the purpose of each:

- Design basis
- Authorization basis
- Engineer safety features
- Safety analysis

d. Describe the requirements for the scope and content of a Nuclear Safety Analysis Report and discuss the general content of each of the required sections of a Nuclear Safety Analysis Report.

e. Discuss the ways that contractor management makes use of Nuclear Safety Analysis Reports.

2.10 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of Department of Energy Technical Standard DOE-STD-1073-93, Guide for Operational Configuration Management Program.

Supporting Knowledge and/or Skills

a. Describe the purpose and objectives of the Operational Configuration Management Program.

b. Discuss what constitutes acceptable contractor compliance consistent with the requirements of DOE-STD-1073-93, Guide for Operational Configuration Management Program, for the following elements of the contractor's Configuration Management Plan:

- Program planning
- Equipment scope criteria
- Concepts and terminology
- Interfaces
- Databases
- Procedures

c. Discuss the following elements of the Configuration Management Program:

- Design requirements
- Document control
- Change control
- Assessments
- Design reconstitution adjunct
- Material condition and aging adjunct

d. Discuss the purpose, concepts, and general process for applying the graded approach to operational configuration management.

2.11 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of DOE Order 4700.1, Project Management System.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of DOE Order 4700.1, Project Management System. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.

b. Discuss the project management terminology for which definitions are provided in DOE Order 4700.1

c. Discuss in detail the roles played by various management levels within the Department as they relate to the project management system.

d. Discuss the purpose of "critical decisions." Include in this discussion the responsible authorities for critical decisions.

e. Describe the process by which projects are designated.

2.12 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the following Department of Energy Technical Standards and Order related to natural phenomena hazards :

- **DOE-STD-1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities**
- **DOE-STD-1021-93, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components**
- **DOE-STD-1022-94, Natural Phenomena Hazards Site Characterization Criteria**
- **DOE Order 5480.28, Natural Phenomena Hazards Mitigation**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the requirements detailed in the listed Standards and Order.

b. Discuss the graded approach process that Department line management uses to determine an appropriate level of coverage by facility maintenance systems personnel. Include in this discussion the factors that may influence the level of coverage.

c. Determine contractor compliance with the listed documents as they apply to contract design requirements and facility maintenance management system activities at a defense nuclear facility.

3. ADMINISTRATIVE

NOTE 1: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

3.1 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of methods to maintain communication with Headquarters, Field elements, and the public.

Supporting Knowledge and/or Skills

a. Describe the Department's organization and discuss the procedures for communicating between elements.

b. Describe the Department's procedures and policy for communicating with the Environmental Protection Agency and other regulatory agencies.

3.2 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of facility maintenance management-related data management requirements.

Supporting Knowledge and/or Skills

a. Describe the local file plan and procedure and the authorized disposition requirements for facility maintenance management-related records contained in DOE Order 1324.2B, Records Disposition.

b. Describe the reporting requirements for occurrence reports categorized as personnel safety occurrence reports per DOE Order 5000.3A, Occurrence Reporting and Processing of Operations Information, Group 3, Personnel Safety.

c. Describe the reporting requirements outlined in DOE Order 5484.1, Environmental Protection, Safety, & Health Protection Information Reporting Requirements.

d. Describe the requirements for documents and records contained in DOE Order 5700.6C, Quality Assurance, Criterion Four, Documents and Records.

e. Discuss the recordkeeping requirements of DOE Order 4330.4B, Maintenance Management Program.

3.3 Facility maintenance management personnel shall demonstrate a working level knowledge of contractor and Department organization and structure as they relate to maintenance management responsibilities and authority .

Supporting Knowledge and/or Skills

a. Define the maintenance organizational structure.

b. Describe the responsibilities of individuals in the organization and their authority.

c. Describe the relationship and interface of the maintenance organization with other organizational structures.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

NOTE 1: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

4.1 Facility maintenance management personnel shall demonstrate a working level knowledge of assessment techniques (such as the planning and use of observations, interviews, and document reviews) to assess facility performance, report results of assessments, and follow-up on actions taken as the result of assessments.

Supporting Knowledge and/or Skills

a. Describe the role of facility maintenance management personnel with respect to oversight of Government-Owned Contractor-Operated (GOCO) facilities.

b. Describe the assessment requirements and limitations associated with the interface with contractor employees.

c. Discuss the essential elements of a performance-based assessment including:

- Investigation
- Fact finding
- Exit interview
- Reporting
- Follow-up
- Closure

d. Describe the following assessment methods and the advantages or limitations of each method:

- Document review
- Observation
- Interview

e. Describe the action(s) to be taken if the contractor challenges the assessment findings and explain how such challenges can be avoided.

4.2 Facility maintenance management personnel shall demonstrate a working level knowledge of lessons learned and problems impacting the Department's maintenance activities across complex.

Supporting Knowledge and/or Skills

a. Describe the documentation of the Department's and industry's "lessons learned" and current events.

b. Discuss recent events that impact maintenance management activities.

c. Discuss current efforts by the Department and the contractor to address issues and recent events.

d. Discuss recent issues identified by external groups (e.g., Defense Nuclear Facilities Safety Board, Environmental Protection Agency, Occupational Safety and Health Act) and Department oversight groups (Environmental Health and Operational Readiness Reviews) that impact facility maintenance.

e. Explain the intent of a Maintenance Problem Analysis Program and discuss a maintenance problem where this program has recently been employed.

4.3 Facility maintenance management personnel shall demonstrate a working level knowledge of the requirements of a maintenance management program .

Supporting Knowledge and/or Skills

a. Describe the structures, systems, and components included in a maintenance management program.

b. Discuss line management's responsibilities for the maintenance management program.

c. Define the term "graded approach" and discuss its application to a maintenance management program.

d. Discuss the application of Technical Safety Requirements in a maintenance management program.

e. Discuss the management systems that control maintenance activities.

f. Describe the mechanisms for feedback of relevant information, such as trend analysis and instrumentation performance/reliability data, to identify necessary program modifications.

g. Discuss the role of configuration management as it relates to maintenance management.

4.4 Facility maintenance management personnel shall demonstrate the ability to conduct independent assessments of a contractor's compliance with the requirements of DOE Order 4330.4B, Maintenance Management Program.

Supporting Knowledge and/or Skills

a. Establish the criteria to be used as a basis for conducting the evaluation.

b. Establish the points of contact with the field organization being evaluated.

c. Gather information pertinent to the evaluation by interviewing personnel, observing maintenance activities and reviewing maintenance records.

d. Document the results of data collection in field notes.

e. Compare the results of the review phase with the criteria established for the evaluation and determine if deficiencies exist.

f. Document the results of the overall evaluation in a formal written report which includes the status of meeting the established criteria, identifies deficiencies or good practices, and suggests recommendations for improvement.

g. Resolve conflicting or inconclusive observations or findings obtained from other evaluators on an evaluation team.

h. Verbally report the results of the evaluation to contractor facility management and Department management.

i. Perform follow-up activities as applicable to ensure implementation of corrective actions, including tracking and close-out.

4.5 Facility maintenance management personnel shall demonstrate a working level knowledge of problem analysis principles and techniques necessary to identify maintenance problems, determine potential causes of problems, and identify corrective action(s).

Supporting Knowledge and/or Skills

a. Discuss the elements of an analysis program.

b. Discuss the guidelines for information collecting.

c. Discuss event causal factors for human performance problems.

d. Discuss event causal factors for equipment performance problems.

e. Describe and explain the application of problem analysis techniques including the following:

- Root cause analysis
- Causal factor analysis
- Change analysis
- Barrier analysis
- Management Oversight Risk Tree analysis

f. Describe and explain the application of the following root cause analysis processes in the performance of occurrence investigations:

- Events and causal factors charting
- Root cause coding
- Recommendation generation

g. Compare and contrast immediate, short term, and long term actions taken as the result of a problem identification or an occurrence.

h. Describe various data gathering techniques and the use of trending/history when analyzing problems.

4.6 Facility maintenance management personnel shall demonstrate the ability to apply problem analysis techniques necessary to identify maintenance problems, determine potential causes, and identify corrective action(s).

Supporting Knowledge and/or Skills

a. Given an event and/or occurrence data, apply problem analysis techniques and identify the problems and how they could have been avoided.

b. Participate in a contractor or Departmental problem analysis and critique the findings and results.

c. Using appropriate data, interpret two fault tree analyses.

4.7 Facility maintenance management personnel shall demonstrate the ability to trend facility maintenance management-related data.

Supporting Knowledge and/or Skills

a. Discuss the key processes used in the trending and analysis of operations information and its relationship to facility maintenance management activities.

b. Discuss the importance and key items of a maintenance history.

c. Given appropriate data, demonstrate the ability to analyze the data.

d. Given DOE Order 5480.26, Trending and Analysis of Operations Information Using Performance Indicators, discuss the key elements of the Order and how they are applied.

e. Given incident/occurrence report data for a specified period, analyze the information for safety trends or compliance problems.

4.8 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of financial management practices and the application of contractor resources to meet commitments to the quality, safety, cost, and schedule of systems.

Supporting Knowledge and Skills

a. Describe the process for preparing cost estimates and budgets.

b. Describe and contrast direct and indirect costs and list ways to reduce indirect costs.

c. Define and explain the relationship between the following terms:

- Budgeted cost of work scheduled (BCWS)
- Budgeted cost of work performed (BCWP)
- Actual cost of work performed (ACWP)
- Earned value (EV)

d. Describe the types of earned value, and how they are measured.

e. Describe the types of data required to forecast cost and schedule performance.

f. Define the term "estimate at completion" (EAC).

g. Discuss the importance of formal change control in relation to project management.

4.9 Facility maintenance management personnel shall demonstrate the ability to perform project management duties as required to provide facility maintenance management technical support to a project.

Supporting Knowledge and/or Skills

a. Support the preparation of a Project Execution Plan.

b. Evaluate a Work Breakdown Structure (WBS).

c. Evaluate a project's critical path schedule.

d. Using the results from an analysis of contractor noncompliance, determine the potential implications and describe how to communicate the results to contractor and Department management.

4.10 Facility maintenance management personnel shall demonstrate a working level knowledge of the Department of Energy (DOE) project management system including the application of contractor resources to meet commitments to quality, safety, cost, and schedule.

Supporting Knowledge and/or Skills

a. Explain the purpose of project management and describe the phases of a typical project.

b. Describe the primary roles and responsibilities of facility maintenance management personnel as outlined in DOE Order 4700.1, Project Management System.

c. Describe typical documents and data sources utilized by facility maintenance management personnel in project management.

d. Identify and explain the major elements of a project and discuss their relationship.

e. Explain the purpose and use of a project execution plan.

f. Discuss the role of configuration management as it relates to project management.

g. Explain the use of safety plans in the management of projects.

h. Discuss the relationship between work breakdown structure (WBS) and cost and schedule.

i. Describe the purpose and use of work packages and/or planning packages.

j. Describe the purpose of schedules, and discuss the use of milestones and activities.

k. Describe the critical path method of scheduling.

l. Explain the concept of a project management baseline and describe the four baselines used in project management.

4.11 Facility maintenance management personnel shall demonstrate a familiarity level knowledge of the Department of Energy/facility contract provisions necessary to provide oversight of a contractor's performance.

Supporting Knowledge and/or Skills

a. Describe the role of facility maintenance management personnel in contractor oversight.

b. Compare and contrast the following:

- The Department of Energy's expectations of an Management and Operating (M&O) contractor
- Management and Operating (M&O) contractor's expectations of the Department of Energy

c. Discuss the key elements and features of an effective Department of Energy and Management and Operating (M&O) contractor relationship.

4.12 Facility maintenance management personnel shall demonstrate the ability to conduct independent assessments of the contractor's maintenance training and qualification program(s) in accordance with DOE Order 4330.4B, Maintenance Management Program, and DOE Order 5480.20, Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities.

Supporting Knowledge and/or Skills

a. Conduct an evaluation of a contractor training and qualification program to verify that qualification requirements have been specified for job categories.

b. Given a work activity that requires special skills or abilities, verify that personnel are qualified prior to performing the work.

c. Assess a work activity requiring specific qualifications to verify that sub-contractors performing the work are qualified to the same level as contractor personnel.

d. Assess the instructor qualifications for a selected maintenance training program to verify that instructors have the necessary credentials and skills to provide the training.

EVALUATION REQUIREMENTS

The following requirements shall be met to complete the Department-wide Facility Maintenance Management Qualification Standard. The evaluation process identified below serves as a measurement tool for assessing whether the participants have acquired the technical competencies outlined in this Standard.

1. Documented completion of the Department-wide General Technical Base Qualification Standard in accordance with the requirements contained in that standard.

2. Documented completion of the competencies listed in this functional area qualification standard. Documentation of the successful completion of these competencies may be satisfied by a qualifying official using any of the following methods:

   - Documented evaluation of equivalencies
   - Written examination
   - Documented oral evaluation
   - Documented observation of performance

CONTINUING TRAINING AND PROFICIENCY REQUIREMENTS

Facility maintenance management personnel shall participate in an Office/facility/position-specific continuing training and qualification program that includes the following elements:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of facility maintenance management personnel as determined by line management. This may include courses and/or training provided by:

   - Department of Energy
   - Other Government agencies
   - Outside vendors
   - Educational institutions

2. Training covering topics that address identified deficiencies in the knowledge and/or skills of facility maintenance management personnel.

3. Training in areas added to the Facility Maintenance Management Functional Area Qualification Standard since initial qualification.

4. Specific continuing training requirements shall be documented in Individual Development Plans (IDPs).